Radiographic Detection of Plastic Catheter Embolus

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■ *Embolization of portions of a plastic intravenous catheter is not a rare occurrence. When plain films do not serve to determine the location of the migrant tubing, special venographic and cardiopulmonary angiographic studies are helpful.*

POPULAR USE OF THE plastic polyethylene catheter for intravenous therapy has resulted in a variety of complications.[4,6,8] Reported experience is beginning to indicate that embolization of the catheter into the deep venous system is not uncommon.* Difficulties in localization of the fragment, which is nonopaque, can be reduced by the proper selection of radiographic studies, based initially on plain films. There are special radiographic procedures for use when plain films do not show where the piece of catheter is lodged.

One of the causes of catheter embolus is severance of the catheter on the sharp beveled needle used to introduce the catheter into the vein. This may happen during withdrawal of the catheter through the needle or following displacement of the plastic guard from the needle point. Another is fracture of the tubing from repeated flexion of the catheter across a joint. There are also reports of accidental cutting of the tubing during dressing changes. In some reported cases the cause of embolization could not be determined. Detection is often clinically important.

The following seven cases are presented to illustrate the roentgenographic patterns in the problem of determining where the migrating catheter fragment is.

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Reports of Cases

CASE 1.—A six-year-old girl was admitted with an injury of the left extremity. An intravenous catheter that was placed in the right arm for maintenance therapy was severed during adjustment. Immediately a tourniquet was applied to

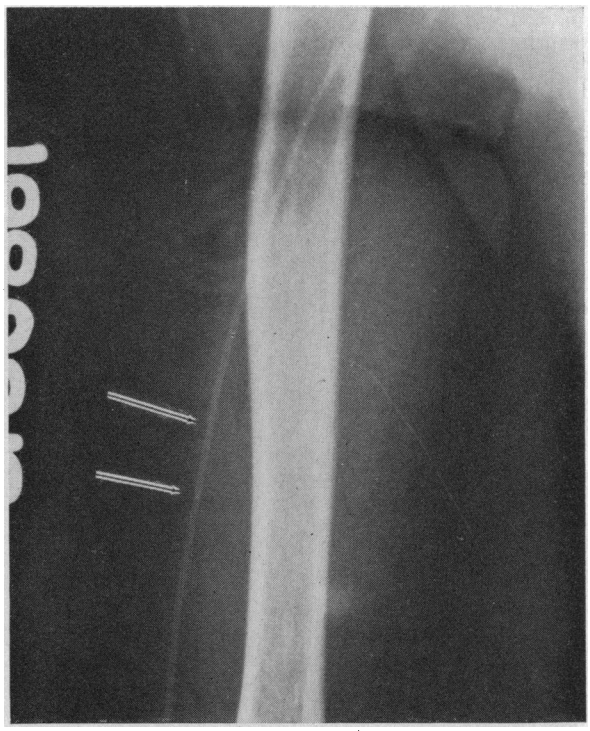

Figure 1.—(Case 1) Plain film soft-tissue study. The catheter was easily identified (arrows). A tourniquet was applied to the proximal arm to arrest central migration.

the arm proximally. When attempts to palpate the severed fragment failed, soft-tissue x-ray examination showed it in the cephalic vein (Figure 1). The vein was opened surgically at the site and the catheter was removed without incident.

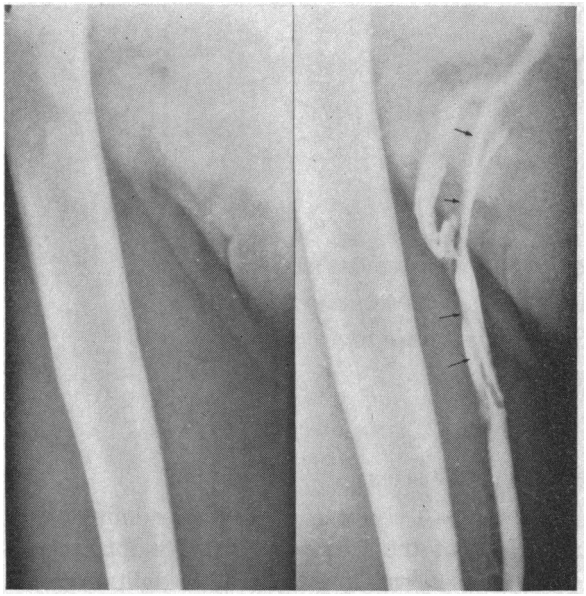

Figure 2.—(Case 3) Catheter embolus. At left, initial plain films failed to indicate site of embolus. At right, a venogram revealed catheter in the cephalic vein appearing as a linear non-branching filming defect.

CASE 2.—An 80-year-old man was admitted in severe cardiac failure. On films of the chest a

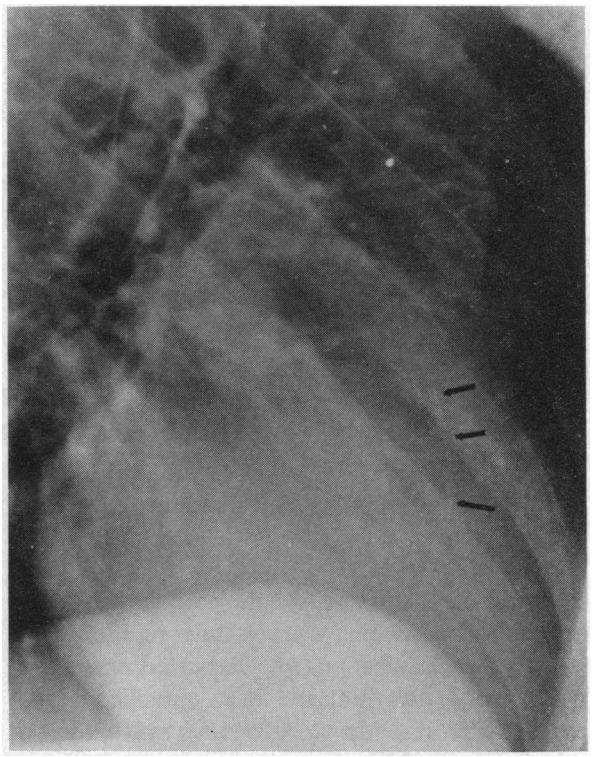

Figure 3.—(Case 4) Plain film of chest. The catheter fragment was identified within the heart on the lateral view.

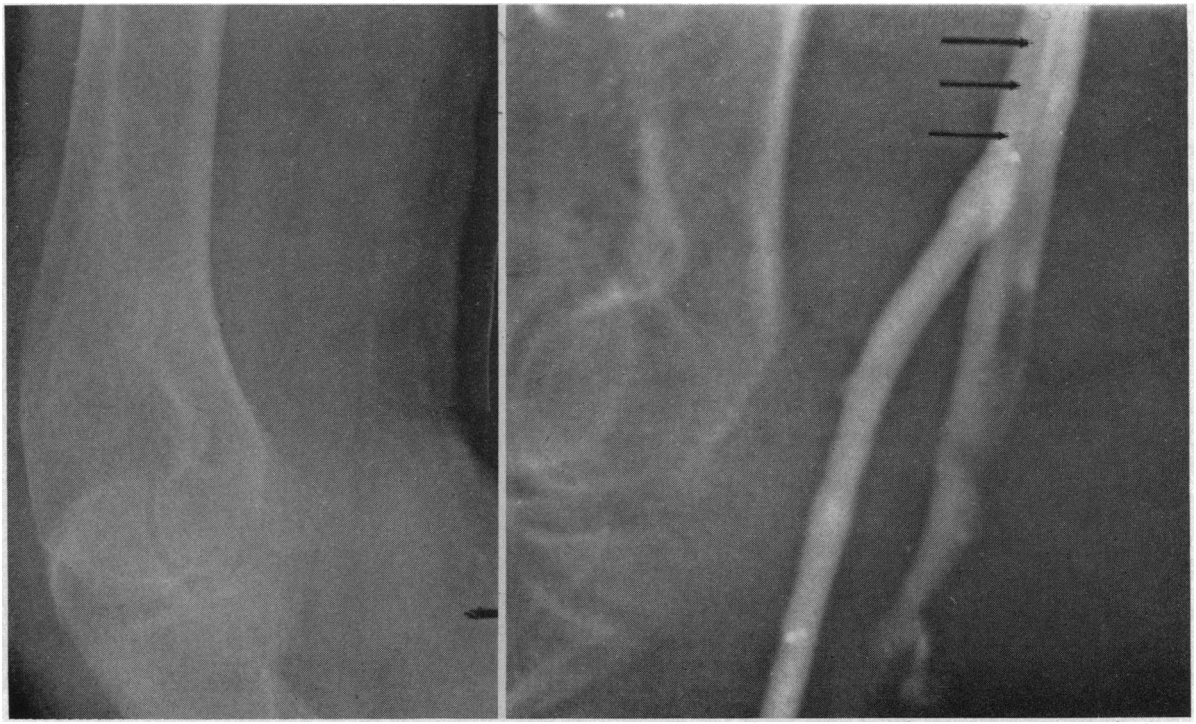

Figure 4.—(Case 5) Plain film failed to reveal location of catheter fragment. Venogram showed it within an anticubital vein.

catheter fragment was identified in a right upper lobe pulmonary artery. How the catheter embolism came about was not known. The patient died of intractable heart failure soon after the x-ray studies identified it. Necropsy confirmed the presence of the catheter fragment described.

CASE 3.—A man 70 years of age was admitted following a gunshot wound in the abdomen. During a stormy postoperative course an intravenous catheter was noted to have been displaced. Initial plain films did not conclusively reveal the fragment but it was successfully demonstrated by venography (Figure 2). The catheter fragment was removed by cut-down.

CASE 4.—A 47-year-old man was admitted in severe dehydration and electrolyte imbalance. A catheter that was placed for intravenous therapy was severed on the sharp needle bevel. A lateral film of the chest showed the fragment lodged within the heart (Figure 3). It was removed by cardiotomy without complication.

CASE 5.—One day after herniorrhaphy in a 58-year-old man it was noticed that a catheter had been displaced. Plain films did not show its whereabouts. Venograms showed it in an antecubital vein (Figure 4). The catheter subsequently migrated into the right ventricle and eventually into the right pulmonary artery as seen on a cardiopulmonary angiogram. No attempt was made to remove it. At last report, three months later, the patient was well.

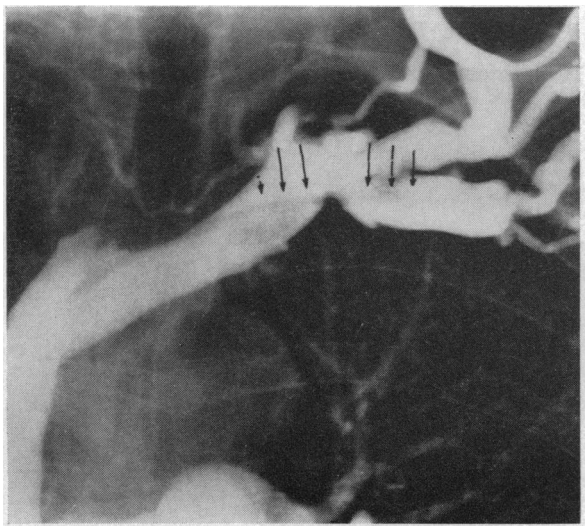

Figure 5.—(Case 6) In a venogram, a portion of 30-cm catheter fragment was seen as a linear filling defect within the left subclavian vein and superior vena cava.

CASE 6.—A 71-year-old woman was admitted to hospital with small bowel obstruction five weeks after resection of the colon. A 30-inch section of a venous cut-down catheter that had been accidentally cut off during a dressing change had migrated centrally. Plain films did not show where it was. A venogram showed it within the superior vena cava and right atrium (Figure 5). It was removed before operation to free the bowel obstruction was undertaken.

CASE 7.—A man 66 years of age was admitted to hospital in alcoholic coma and severe dehydration. An intravenous catheter that was being placed for therapy was severed by the needle. Plain films did not determine the site of the migrating portion, but a pulmonary angiogram showed it in the right pulmonary artery, without evidence of obstruction (Figure 6). The patient was asymptomatic and discharged to the clinic.

Discussion

Methods of radiographic detection of the plastic catheter are based initially on routine plain film studies of probable sites of embolization.[2] The

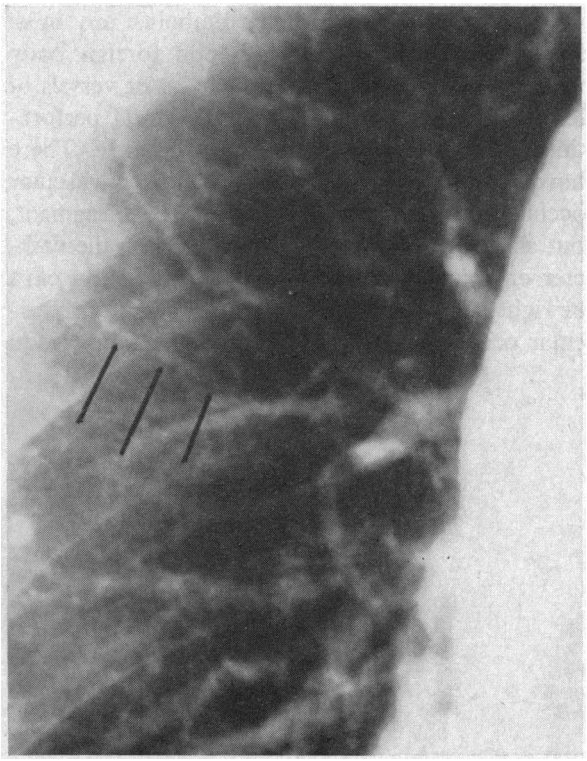

Figure 6.—(Case 7) Pulmonary angiogram, the catheter fragment was not seen on plain films. On angiographic study it appeared as a linear, non-branching filling defect within a right pulmonary artery branch.

extremities are best studied with good soft-tissue technique and good collimation to reduce scatter and enhance the difference in translucency between the tubing and fat. Contrast of the low opacity catheter is greatest in the 60 to 70 KV range, and tends to decrease with KV above 90. After careful study based on suspicion of embolization, films of the chest taken with 90 to 120 KV technique usually demonstrate the position of the tubing.

Special radiographic studies are indicated when plain films fail to demonstrate the catheter fragment.[1,2] The venogram is performed by intravenous injection of contrast material, distal to the site of suspected embolus. This is not without complication, as the catheter may be displaced centrally during or immediately after injection. Hence it is necessary to be prepared to carry out further angiographic studies should central displacement occur.

Cardiopulmonary angiography has been successful in demonstrating the catheter fragment in the superior vena cava, in the right atrium and ventricle and in pulmonary arteries. The catheter appears as a linear filling defect within the injected contrast material.

Complications of catheter embolus are most frequently a response to a septic foreign body within the venous system, right heart or vessels of lesser circulation.[9,10] Two cases of fatal perforation of the heart have been reported.[3,7] There have been no reports of acute pulmonary vascular occlusion caused directly by the plastic fragment, but since propagation of thrombus from the catheter embolus lying within the superior vena cava or right heart has been described,[1] significant vascular occlusion might occur from that source. On the other hand, long-term survival has been reported [11,12] with the fragment of tubing left in place. In these cases the clinical course may be uneventful.

Clinicians must reevaluate the practical indications for use of the plastic intravenous catheter and the method of application to limit the frequency of complication.

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